4.2.P06

Groundwater inflow affects acidity budgets in sediments of highly acidic post-mining lakes

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Lakes in former open cast mining pits are often strongly acidified by input of ferrous iron generated in the adjacent mining dumps. The input of acidity is reduced when ferrous iron is adsorbed or precipitated in the sediment before entering the lake water. Burial of iron sulfides following sulfate and iron reduction also consumes acidity. Previous studies suggested that sediment pH controls sulfate and iron reduction and the formation of iron sulfides or carbonates. The hypothesis was tested that the inflow of only moderately acidic groundwater (pH 4.5) increases the retention of ferrous iron as iron sulfides and carbonates in the sediment of acidified Lake 77 (Lusatia, Germany).

The hypothesis was tested by developing acidity budgets for two sediments of differential groundwater inflow (ca. 1 and 10 L m^{-2} d^{-1}) from iron and sulfur inventories, pore water chemistry and turnover measurements. These results are compared to laboratory column experiment, where lake sediment was percolated with artificial groundwater of different pH-values (2.8 and 5) and flow rates (5 and 20 mm d^{-1}). Changes in sediment and pore water chemistry were estimated by sampling percolate, solid phase and pore water profiles.

In the presence of groundwater inflow from the tailing area, sediment pH was elevated (5.5) compared to the lake (2.8) and groundwater (4.5). In the absence of groundwater inflow, the pH value in the sediment was around 3. Ground water inflow also increased sulfate (28 vs. 8.5 mmol L^{-1}) and iron (11.5 vs. 4 mmol L^{-1}) concentrations compared to the area without such inflow. In the presence of groundwater inflow, sulfate consumption in the sediment (3.6±1.9 mol m^{-2} yr^{-1}) was also higher than without such inflow (around zero). Elevated rates of sulfate reduction and pH were in agreement with higher TRIS (10 to 30 vs. 2.5 to 9 µmol g^{-1}) and carbonate concentrations (up to 55 vs. 20 µmol g^{-1}). Only in the presence of groundwater inflow, acidity consuming processes were larger than acidity generating processes, mainly transformation of schwertmannite into goethite. The study demonstrates that in acidic and iron rich lakes the hydrological boundary conditions affect geochemical processes, the iron and sulfur cycle and acidity fluxes.

4.2.P07

Impact of a phytoplanktonic bloom on the trace concentrations of amazonian floodplain lakes (Lago de Curuaï, Para, Brazil)

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The Amazon river is one of the most important source of fresh water to the Ocean (~15% of the word fresh water discharge) and contribute significantly to the chemical fluxes to the global ocean. The most part of the Amazon basin is characterised by an extremely low declivity (1 cm/km), and an extended floodplain, which is controlling the liquid and solid transfers to the Ocean trough the storage of large volume of waters during the floods and strong sedimentation processes. These wetland areas constituted by a complex networks of thousands of lakes, named *várzeas*, extend over more than 300 000 km² [1 ; 3] and represent one of the most productive ecosystems of the world due to the regular enrichment in nutrients by the river waters. These roles set the "*várzeas"* as key areas to understand the whole transfer process through the Amason basin.. In order to understand which biochemical processes control the concentration and fate of chemical elements inside this ecosystem, an extended scientific survey was conducted in the Curuaï floodplain area (56°1'W, 55°W ; 1°9'S, 2°3'S, Para State, Brazil). With an extention about 1900 km² at the high water level, the Curuai floodplain lakes system is representative of the Amazon basin.

As the Amazon water is stored in this floodplain, the particular conditions induced by the river regime associated with the high vegetation productivity, generates in turn various transformation and degradation processes of the elements present in the river water [2]. One of these process is due to the occurrence of phytoplanktonic blooms. Using a multielement analysis approach in a first step, we present the main biochemical features affecting both major and trace elements during a bloom period. Speciation calculations using minteq code were then used to model the observed results.

A first approach on our results show depletion in dissolved phase for Mn, Y, REE and Th and excess in dissolved phase for Cr, As, Cs and Pb. Thess results might be confirmed by further research.

References

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