Kinetics of Cr(VI) reduction in mangrove sediment, Vavouto Bay, New Caledonia

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The mangrove of Vavouto Bay is subject to Cr input from Koniambo Mountains where ancient and new mining activities of Ni ore increase mine tailing deposit and natural erosion rates. In order to predict the fate of chromium through mangrove vegetated sediment, we extracted kinetic parameters which can be implemented into reactive transport models. More specifically, we focused our work on Cr(VI)/Cr(III) transformation, by injecting deaereted mixtures of Cr(VI)+NaCl or Cr(VI) + seawater in flow-through reactors (FTR) filled with undisturbed sediment.

Here we present first results from pore water concentrations and solids (concentrations, mineralogy) vertical profiles collected along a transect through mangrove typical zones (Rhizophora sp., Avicennia marina and unvegetated salt flats) for two corresponding drainage basins (CF and Coco rivers, highly impacted vs. lightly impacted basin by suspended matter from mine tailings).

Kinetic experiments were performed at three depths range (3-5, 23-25 and 42-44 cm) in Avicennia sediment of CF mangrove in a Jacomex gloves box (O2<30 ppmv). Fe, Mn, DOC, DIC, Alk, pH, Cr(VI), Cr(III) and Cr(total) were monitored to help understanding ongoing processes (spectrophotometry and chemiluminescence methods were run in 96-wells microplates on TECAN infinite 200, HR-ICP-MS analyses were run on a ThermoFisher Element 2). Working Cr(VI) concentrations ranged between 1 and 20 µM. Optimized flow rate was set up at 7 mL/hr through a surface of 17 cm^2 and a thickness of 1 cm. Numerical simulation of reactive transport through the reactor slice was used to extract kinetic parameters at quasi steady state conditions. First results show a high sediment reactivity with high potential Cr(VI) consumption rates that vary depending on sediment mineralogy and organic content.

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