Geophysical Research Abstracts
Vol. 16, EGU2014-6136, 2014
EGU General Assembly 2014

Natural organic matter as electron acceptor: experimental evidence for its important role in anaerobic respiration

Maximilian Peter Lau (1), Michael Sander (2), Jörg Gelbrecht (1), and Michael Hupfer (1)

(1) Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Chemical Analytics and Biogeochemistry, Berlin, Germany, (2) Swiss Federal Institute of Technology (ETH) Zurich, Department of Environmental Systems Science, Institute for Biogeochemistry and Pollutant Dynamics, Zurich, Switzerland

Microbial respiration is a key driver of element cycling in oxic and anoxic environments. Upon depletion of oxygen as terminal electron acceptor (TEA), a number of anaerobic bacteria can employ alternative TEA for intracellular energy generation. Redox active quinone moieties in dissolved organic matter (DOM) are well known electron acceptors for microbial respiration. However, it remains unclear whether quinones in adsorbed and particulate OM accept electrons in a same way. In our studies we aim to understand the importance of natural organic matter (NOM) as electron acceptors for microbial energy gain and its possible implications for methanogenesis. Using a novel electrochemical approach, mediated electrochemical reduction and -oxidation, we can directly quantify reduced hydroquinone and oxidized quionone moieties in dissolved and particulate NOM samples. In a mesocosm experiment, we rewetted sediment and peat soil and followed electron transfer to the inorganic and organic electron acceptors over time. We found that inorganic and organic electron acceptor pools were depleted over the same timescales. More importantly, we showed that organic, NOM-associated electron accepting moieties represent as much as 21 40% of total TEA inventories. These findings support earlier studies that propose that the reduction of quinone moieties in particulate organic matter competitively suppresses methanogenesis in wetland soils. Our results indicate that electron transfer to organic, particulate TEA in inundated ecosystems has to be accounted for when establishing carbon budgets in and projecting greenhouse gas emissions from these systems.