Geophysical Research Abstracts
Vol. 20, EGU2018-17243, 2018
EGU General Assembly 2018

Laboratory investigations of copper acquisition – an important cofactor in methane oxidation

Danielle Rushworth (1), Carolina Reyes (1), Lea Steinle (2), Walter Schenkeveld (1), Moritz Lehmann (2), and Stephan Kraemer (1)

(1) University of Vienna, Environmental Geosciences, Wien, Austria (danielle.rushworth@univie.ac.at), (2) The University of Basel, Biogeochemistry, Basel, Switzerland

Laboratory investigations of copper acquisition – an important cofactor in methane oxidation
DANIELLE D. RUSHWORTH1, CAROLINA REYES1 , LEA STEINLE2, WALTER D.C. SCHENKEVELD1*, MORITZ F. LEHMANN2, STEPHAN M. KRAEMER 1
1 University of Vienna, Dept. of Environmental Geosciences, Althanstrasse 14 UZAII 1090 Vienna, Austria (*correspondence:walter.schenkeveld@univie.ac.at)

2 University of Basel, Dept. of Environmental Geosciences,
Bernoullistrasse 32 CH-4056 Basel, Switzerland

Methane-oxidizing bacteria (MOB) such as the microaerophylic bacterium Methylosinus trichosporium OB3b play a vital role in mitigating and reducing emmisions of the potent greenhouse gas methane (CH4). Most methanotrophic bacteria, including M.trichosporium OB3b are known to posess the copper (Cu) –bearing enzyme particulate methane monooxygenase (pMMO) which is responsible for catalyzing the conversion of CH4 to methanol. These bacteria therefore have a high Cu requirement which can be satisfied in Cu-limiting conditions through a high-affinity acquisition mechanism that may involve the exudation of Cu-specific ligands termed chalcophores. Methanobactin (mb) is a chalcophore exuded by M.trichosporium OB3b which has been sucessfully isolated and characterised in the laboratory. In fresh water environments methanotrophs can cope with very low O_2 concentrations and often reside close to, or even below, the oxic-anoxic interface. A hypothesis underlying this project is that low sulfide concentrations may diffuse across the redox boundary leading to the non-equilibrium formation of Cu-bearing sulfide phases (Cu-sulfides). This could cause low Cu bioavailability and a corresponding production of Mb.

As the reactivity of mb to Cu-sulfides is not yet known, we will investigate and elucidate the mechanisms of Cu acquisition by mb in the laboratory. This investigation involves kinetic dissolution experiments of covellite (CuS), a Cu(I)-bearing sulfide mineral synthesized in the laboratory, in the presence of mb under anoxic conditions. Mb was isolated and purified following previously established methods1. Given the requirement of (at least) traces of oxygen by MOB in freshwater environments we will also conduct kinetic dissolution experiments of CuS in the presence of oxygen and absence of mb to compare rates of oxidative dissolution to rates of mb-promoted dissolution. This is essential for understanding where mb production in natural environments is likely to occur and for elucidating rates of Cu-acquisition by MOB.

[1] L. Pesch et al., (2011), GEOCHEM TRANS. doi: 10.1186/1467-4866-12-2