Laboratory and field investigations of methanotrophic copper acquisition

DANIELLE D. RUSHWORTH[1], CAROLINA REYES[1] , LEA STEINLE[2], WALTER D.C. SCHENKEVELD[1]*, MORITZ F. LEHMANN[2], 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

Methanotrophic bacteria play an important role in the global carbon cycling, as well as in mitigating emmissions of the potent greenhouse gas methane (CH_4) to the atmosphere. Most known methanotrophs possess the copper (Cu) -bearing methane monooxygenase (pMMO), an enzyme catalyzing the conversion of CH_4 to methanol. Under Cu limitation, methanotrophic microorganisms may satisfy their relatively high Cu requirement through a high-affinity acquisition mechanism that involves the exudation of Cu-specific ligands, termed chalcophores. A chalcophore that has been succesfully isolated and purified from the aerobic CH_4-oxidizing bacteria *Methylosinus trichosporium* OB3b is Methanobactin (mb). Mb production is likely to occur in the vicinity of oxic-anoxic interfaces, where Cu limitation due to the formation of Cu-sulfide phases may be expected. To our knowledge, however, it has not been detected in the natural environment. Also its reactivity towards Cu-sulfide phases is not known.

In this project we will investigate methanotrophic Cu acquisition in laboratory and field studies. We aim to elucidate the mechanisms involved in Cu aqcuisition from Cu-sulfides by mb-promoted dissolution of these minerals. This will be investigated through kinetic dissolution and adsorption experiments conducted under anoxic conditions. Essential work has been done to isolate and purify mb from the bacteria *M.trichosporium* following previously improved methods. A Cu(I)-sulfide phase was synthesized and dissolution rates and mechanisms in the presence of chalcophores and model compounds were investigated. Experimental data will ultimately be integrated with field measurements employed to further constrain anticipated links between Cu availability, sulfide concentrations, CH_4-oxidation rates and mb production.