



Conference Abstract

Investigating Manganese-oxidizing microbial Biofilms in a historic Copper Mine of Upper Frankonia

Tillmann Lueders[‡], Christopher Mechela[‡], Felix Beulig[‡], Martin Obst[‡]

[‡] University of Bayreuth, Bayreuth, Germany

Corresponding author: Tillmann Lueders (tillmann.lueders@uni-bayreuth.de)

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Abstract

Providing evidence for presumed chemolithoautotrophic manganese oxidation remains a major and challenging objective in subsurface microbiology. Here, we report on the dissection of blackish, leathery microbial biofilms discovered in the “Goldene Falk”, a historic copper mine in Northern Bavaria, with mine shafts originating back to the 15th century. Biogeochemical analysis of the biofilm indicated a notable enrichment of manganese oxides (MnOX), with Mn making up for more than 10% (dry weight) of the deposits. STXM analysis suggested a clear biogenic origin of MnOX *in situ*. Characteristic nodules of MnOX with microbial cells attached were also found in aerobic Mn-oxidizing enrichment cultures set up in minimal media in the lab. The biofilms obtained from the mine were also subjected to amplicon and metagenomic sequencing, revealing a vast diversity of presumably chemolithoautotrophic and heterotrophic microbial lineages, including members of the *Pyrinomonadaceae*, *Rhizobiales*, *Methylomirabilaceae* and also lineages within the *Nitrospiraceae* previously reported to be associated with lithotrophic Mn oxidation. We reconstructed >100 high-quality bacterial genomes (MAGs), many of them carrying genomic signatures of biogenic Mn oxidation (albeit non-lithotrophic). We continue to investigate the biofilms, our enrichment cultures and the metagenomic data obtained from the mine for further evidence of possible autotrophic manganese oxidation, the macroscopic leathery biofilm representing a likely habitat for these still enigmatic microbes.

Indications for nitrogen and sulfur cycling also ongoing in the biofilms will also be discussed. This research contributes to a better understanding of the yet-enigmatic capacities of the microbiota in man-made subsurface environments.

Keywords

Cave and mine microbiology, subsurface biofilms, chemolithoautotrophy, biogeochemical Mn cycling, metagenomics

Presenting author

Tillmann Lueders

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Hosting institution

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Conflicts of interest

The authors have declared that no competing interests exist.