Microbial community analyzis and connection to Iron chemistry in a former uranium mine — Lake Tranebärssjön

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Aim, site description and sampling

The aim of this study was to investigate the connection between biogeochemical functions and bacterial community composition in lakes with focus on the consequences for metal mobilization and transport in mining areas.

As study site we used Lake Tranebärssjön, the now water filled open-pit at the closed uranium mining site at Ranstad, Sweden. The water column was sampled at stratified conditions in late summer at the deepest part of the lake. Samples were analyzed for chemistry, dissolved organic carbon (DOC) and metals. The bacterial communities of the samples were monitored by 454-pyrosequensing of 16SrRNA genes and cloning of the full 16SrRNA gene.

Results and discussion

The water inflow is dominated by groundwater and the surrounding bedrock is mainly alum-shale and limestone resulting in high alkalinity, sulphate (1.3 gL^{-1}) as well as Fe (50 mgL^{-1}) and other metals in the anoxic bottom water while pH is lower (6.9) compared to oxygenated surface water (7.9).

The microbial community of the anoxic bottom water differs completely from the surface water and is dominated by a *Chlorobium* sp. (20-40% of population), an anoxic phototrophic oxidizer of inorganic sulphur or iron compounds, and Delta-proteobacteria (12-15% of population) represented by sulphate and iron reducing bacteria.

The results imply that the hydrogeochemical environment controls the composition of the microbial populations and suggest close interactions between microbial community and chemistry in the iron and sulfate rich bottom water. With the results from the cloning of the total 16SrRNA gene we hope to shed more light on these interactions and the consequences for the environment.

Chinese cave climate records

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Using refined multi-collector inductively-coupled plasma mass spectrometric techniques, we have determined precise ^{230}Th ages for cave calcite sequences at key sites in China. In total, we have established more than 300, 000 years of record, with resolution in terms of oxygen isotope values of several decades or better.

The sites span the region affected by the East Asian Monsoon, in SE China, to the region affected by both the Indian and East Asian Monsoons in SW China, to high altitude regions of central Tibet, to areas of NW China at the fringes of summer monsoon precipitation, and beyond, to the semi-arid NW where climate is dominated by the westerlies. Patterns of oxygen isotope variation are broadly similar thoughout this region, particularly at the orbital scale; however, clear differences are evident at the millennial scale. These observations are broadly consistent with the idea that the cave oxygen isotope variations are caused by temperature anomalies in the North Atlantic, which modulate seasonal atmospheric circulation patterns by controlling the seasonal position of the sub-tropical jet, and therefore, the degree to which the jet impinges on the Tibetal Plateau seasonally.

Whereas the Chinese records contribute inherently to our understanding of climate change, they are also invaluable in setting the timing of climate change worldwide. These records are among the most precisely dated climate records. Equally important, they can be correlated with other cave records as well as some marine and ice core records. Thus, they can be used to establish the timing of a wide-range of records world-wide. These correlations are particularly valuable in establishing the sequence of events and plausible causes of events during ice age terminations.