# Geomicrobiology of a Meromictic Lake Water Column Containing Relict Seawater

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Meromictic lakes support extreme biogeochemical conditions that might be analogous to those in ancient oceans. Powell Lake (British Columbia, Canada) is a 350-meter deep ex-fjord containing relict seawater below ca. 300 m. The strongly stratified seawater has been separated from contact with the atmosphere and ocean since the last glacial period and has been subject to very little mixing. Water samples from a detailed vertical profile were obtained for geochemical and molecular analyses. Here we present microbial community composition and metagenomic data relevant to carbon, nitrogen (N), sulfur and metal cycling.

Based on phylogenetic and functional marker genes, we observed vertical stratification of microbial taxonomic groups and genetic potential for biogeochemical processes consistent with the geochemical profiles. Genetic potential for the oxidation of upward diffusing reductants ($CH_4$, $NH_4^+$, $H_2S$, CO) was highest in the suboxic (<6 µM $O_2$) zone that separated the hypoxic hypolimnion from the sulfidic monimolimnion. Marker genes for dissimilatory N reduction (*nrfA*, *napA*) were found inside the sulfidic zone, where obvious nitrate sources were absent. Binning of metagenomic reads revealed potential for sulfide oxidation combined with partial denitrification and DNRA predominantly in *Betaproteobacteria*. The microbial communities in the deep water samples, including the relict seawater zone, were dominated by *Planctomycetes*, *Chloroflexi* and former candidate phyla *Omnitrophica* (OP3), *Aminacenantes* (OP8), *Atribacteria* (OP9) and *Cloacamonetes* (WWE1). Genetic potential at depth was defined by anaerobic carbon fixation, N remineralization and thiosulfate/ polysulfide reduction. Additionally, potential for fermentation and methanogenesis was found in the deepest water.

Our results provide insights into genetic and phylogenetic potential for biogeochemical cycling along a highly resolved vertical profile through a deep anoxic water column. Ongoing research is employing stable isotope techniques targeting various N compounds ($\delta^{15}N$) to investigate observed peculiarities in Powell Lake's N cycle.